

**Spring Creek Embayment  
Pickwick Reservoir  
Intensive Basin Survey 2015**

**PICL-2:** Spring Creek approx 1 mi upstream of confluence with TN River (Colbert Co 34.73944/-87.73083)

**BACKGROUND**

The Alabama Department of Environmental Management (ADEM) began monitoring lake water quality statewide in 1985, followed by a second statewide survey in 1989. In 1990, the Reservoir Water Quality Monitoring Program [now known as the Rivers and Reservoirs Monitoring Program (RRMP)] was initiated by ADEM.

The current objectives of this program are to provide data that can be used to assess current water quality conditions, identify trends in water quality conditions and to develop Total Maximum Daily Loads (TMDLs) and water quality criteria. Descriptions of all RRMP monitoring activities are available in ADEM’s 2012 Monitoring Strategy (ADEM 2012).

In 2015, ADEM monitored the Spring Creek tributary embayment of Pickwick Reservoir as part of the basin assessment of the Tennessee River under the RRMP. This site was selected using historical data and previous assessments. The purpose of this report is to summarize data collected in the Spring Creek embayment (PICL-2) during the 2015 growing season (Apr-Oct). This is the fourth basin assessment of the Tennessee River since ADEM began sampling. Monthly and/or mean concentrations of algal biomass/productivity [chlorophyll *a* (chl *a*)], sediment [total suspended solids (TSS)], and trophic state [Carlson’s trophic state index (TSI)] from 2015 were compared to ADEM’s historical data and established criteria.



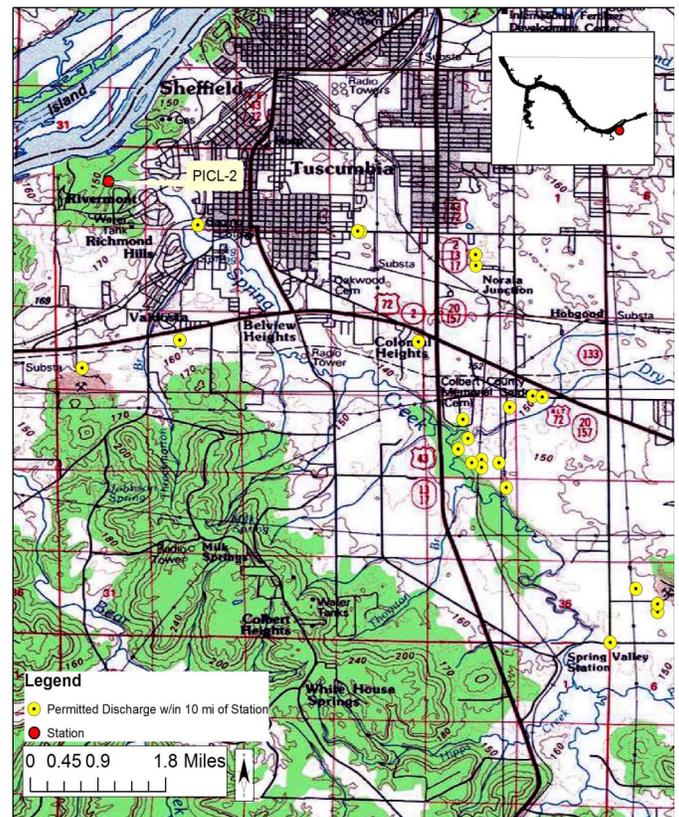
**Figure 1.** Photo of Spring Creek at PICL-2

**WATERSHED CHARACTERISTICS**

Watershed land uses are summarized in Table 1. Spring Creek is classified as a *Fish & Wildlife (F&W)* stream located in the Eastern Highland Rim ecoregion (71g). Based on the 2006 National Land Cover Dataset, land use within the 108 mi<sup>2</sup> watershed is mixed (Fig. 3). The lower portion of the watershed is predominantly agriculture and urban while the upper portion is mostly forest. As of January 28, 2016, ADEM has issued a total of 74 NPDES permits within the watershed. Twenty-three of those permits are located within 10 mi of the station (Fig. 2).

**SITE DESCRIPTION**

The Spring Creek embayment at PICL-2 is located just west of Sheffield/Tuscumbia, AL. Spring Creek has a mean bottom depth of 4.3 m (Table 2) at the sampling location and is dominated by filamentous algae in the spring and submersed vegetation like *Hydrilla sp.* and parrot’s feather (*Myriophyllum aquaticum*) much of the summer.



**Figure 2.** Map of Spring Creek Embayment of Pickwick Reservoir. Though additional permitted discharges may occur in the watershed (Table 1), only those discharges within 10 miles upstream of the station are displayed on the map.

## METHODS

Water quality assessments were conducted at monthly intervals, April-October. All samples were collected, preserved, stored, and transported according to procedures in the ADEM Field Operations Division Standard Operating Procedures (ADEM 2015), Surface Water Quality Assurance Project Plan (ADEM 2012), and Quality Management Plan (ADEM 2013).

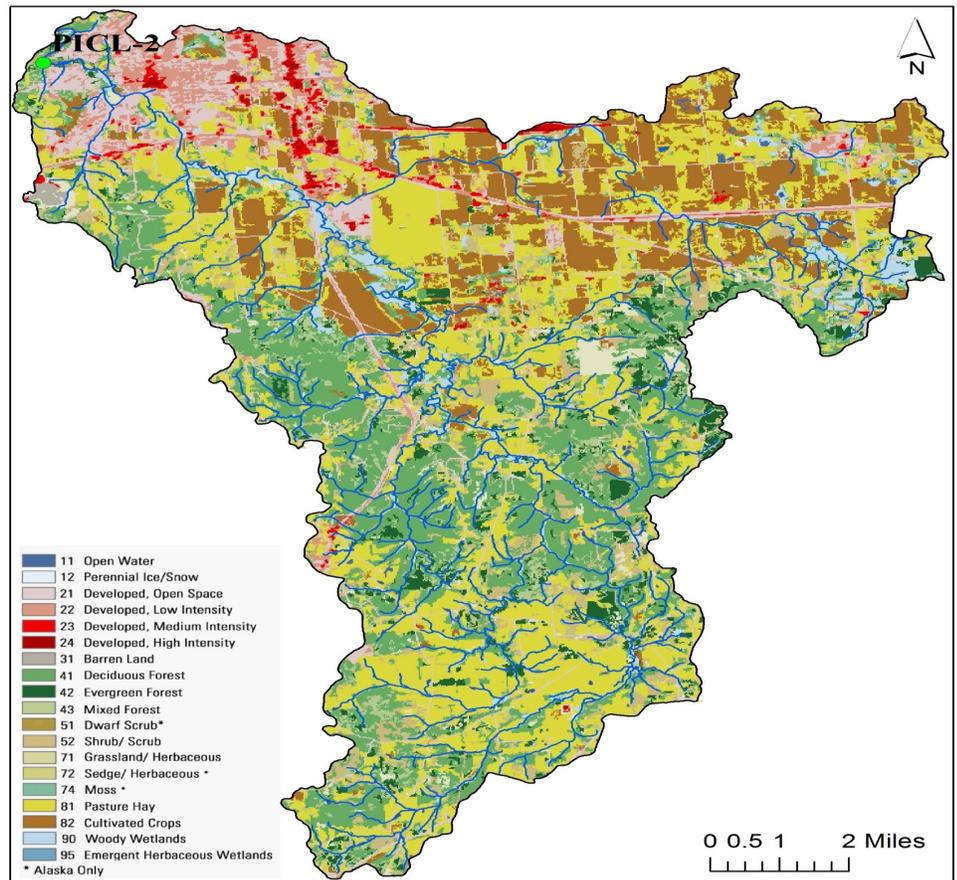
Mean growing season chl *a*, TSI, and TSS were calculated to evaluate water quality conditions. Monthly concentrations of these parameters were graphed with ADEM's previously collected data to help interpret the 2015 results. Carlson's TSI was calculated from the corrected chl *a* concentrations.

**Table 1: Summary of Watershed PICL-2**

Basin		Tennessee R
Drainage Area (mi <sup>2</sup> )		108
Ecoregion <sup>a</sup>		71g
% Land use		
Open Water		<1%
Developed	Open Space	8%
	Low Intensity	4%
	Medium Intensity	1%
High Intensity		<1%
Barren Land		<1%
Forest	Deciduous Forest	22%
	Evergreen Forest	4%
	Mixed Forest	4%
Shrub/Scrub		8%
Herbaceous		2%
Hay/Pasture		29%
Cultivated Crops		13%
Woody Wetlands		3%
# NPDES Permits <sup>b</sup>		TOTAL 74
Construction Stormwater		25
Mining		3
Small Mining		1
Industrial General		32
Industrial Individual		11
No Exposure		0
Municipal		0
Underground Injection Control		2

a. Eastern Highland Rim

b. #NPDES outfalls downloaded from ADEM's NPDES Management System database, Jan 28, 2016.



**Figure 3. Land use within the Spring Creek watershed at PICL-2.**

## RESULTS

The following discussion of results is limited to those parameters which directly affect trophic status or parameters which have established criteria. Results of all water chemistry analyses are presented in Table 2. The axis ranges of the graphs in Fig. 4-5 were set to maximum values reservoir-wide so all embayment reports on the same reservoir could be compared.

In 2015, the growing season mean TN was lower than 2013. Monthly TN was highest in May (Fig. 4).

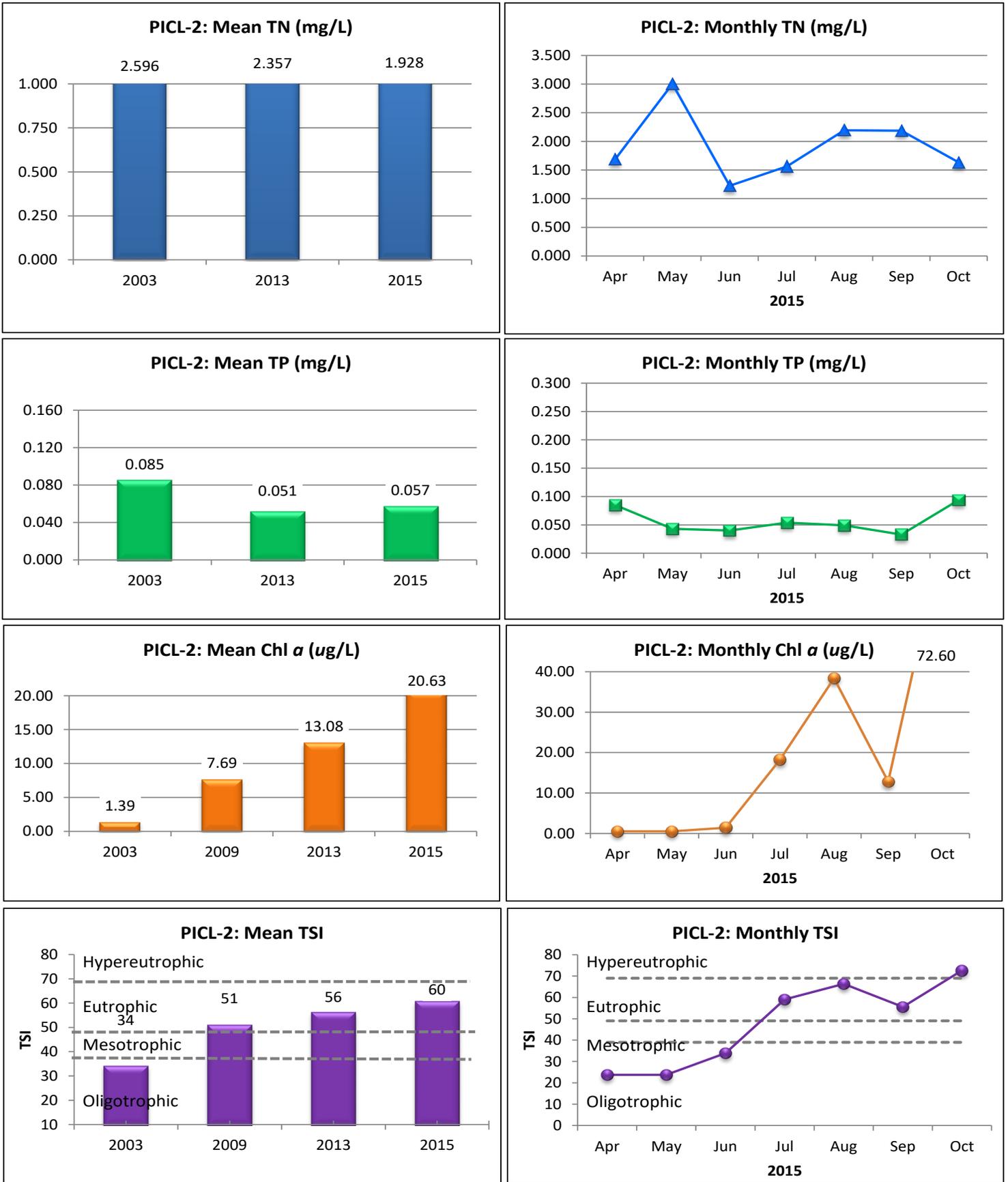
The growing season mean TP concentration from 2013 to 2015 showed minimal increase. Monthly TP was highest in October and displayed little fluctuation during the growing season.

Growing season mean chl *a* value was higher in 2015 than any previous sample year (Fig. 4). Monthly chl *a* concentrations sharply peaked in October.

Mean TSI was eutrophic in 2015. Monthly TSI in Spring Creek increased to hyper eutrophic conditions in October (Fig. 4).

The mean growing season TSS value was higher in 2015 than 2013 (Fig. 4). Monthly TSS concentration was highest in April.

Dissolved oxygen concentration in the PICL-2 station was above the ADEM criteria limit of 5.0 mg/l at 5.0 ft (1.5 m) in all months (ADEM Admin. Code R. 335-6-10-.09) (Fig. 6).



**Figure 4.** Mean growing season (2003-2015) and monthly (April-October, 2013) chl *a*, TSI, and TSS measured in the Spring Creek embayment of Pickwick Reservoir. Vertical axis ranges are set to maximum values reservoir-wide for comparability between embayment reports within the same reservoir. 2009 mean TN and mean TP data did not meet ADEM QA standards and are not included.

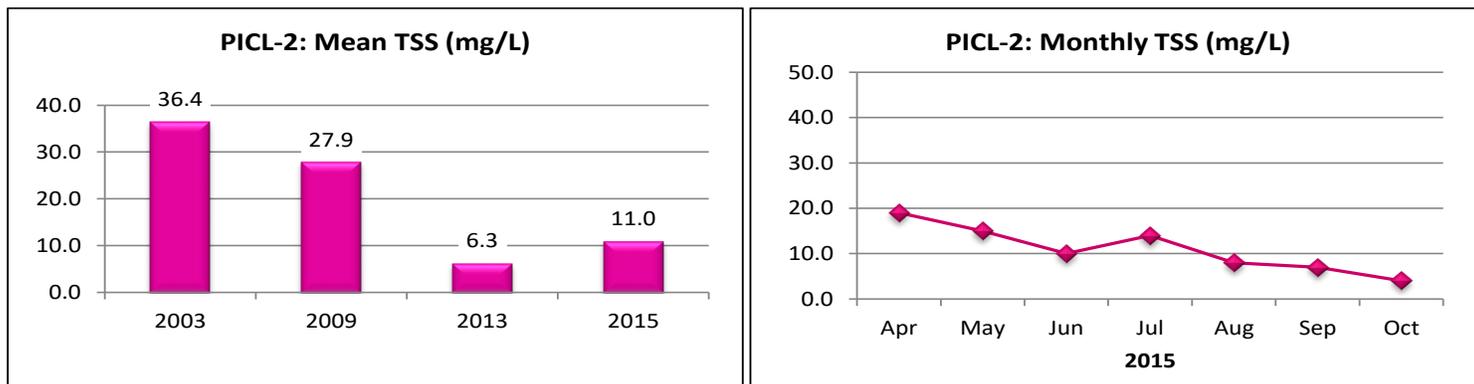


Figure 5. Mean growing season and monthly TSS measured in the Spring Creek embayment of Pickwick Reservoir.

Table 2. Summary of water quality data collected April-October, 2015. Minimum (Min) and maximum (Max) values calculated using minimum detection limits. Median (Med), Mean, and standard deviations (SD) values were calculated by multiplying the MDL by 0.5 when results were less than this value.

PICL-2	N	Min	Max	Med	Mean	SD
<b>Physical</b>						
Turbidity (NTU)	7	6.0	31.1	7.1	11.8	9.3
Total Dissolved Solids (mg/L)	7	119.0	207.0	148.0	153.7	30.4
Total Suspended Solids (mg/L) <sup>J</sup>	7	4.0	19.0	10.0	11.0	5.2
Hardness (mg/L)	4	102.0	136.0	102.0	110.5	17.0
Alkalinity (mg/L)	7	84.7	164.0	96.0	113.7	30.6
Photic Zone (m)	7	1.36	4.50	3.80	3.52	1.10
Secchi (m)	6	1.11	1.56	1.16	1.24	0.17
Bottom Depth (m)	7	3.0	5.4	4.1	4.3	0.8
<b>Chemical</b>						
Ammonia Nitrogen (mg/L)	7	< 0.010	0.210	0.005	0.061	0.084
Nitrate+Nitrite Nitrogen (mg/L)	7	0.395	2.970	1.167	1.318	0.883
Total Kjeldahl Nitrogen (mg/L)	7	< 0.064	1.170	0.522	0.610	0.400
Total Nitrogen (mg/L)	7	< 1.227	3.002	1.689	1.928	0.586
Dis Reactive Phosphorus (mg/L) <sup>J</sup>	7	0.008	0.040	0.020	0.023	0.011
Total Phosphorus (mg/L)	7	0.033	0.094	0.049	0.057	0.023
CBOD-5 (mg/L) <sup>J</sup>	7	< 2.0	2.1	1.0	1.2	0.4
Chlorides (mg/L)	7	3.1	10.4	7.9	7.4	2.5
<b>Biological</b>						
Chlorophyll a (mg/m <sup>3</sup> )	7	< 1.00	72.60	12.80	20.63	26.66
E. coli (MPN/DL) <sup>J</sup>	3	32	1,300	68	467	722

<sup>J</sup>= one or more of the values is an estimate; N= # samples.

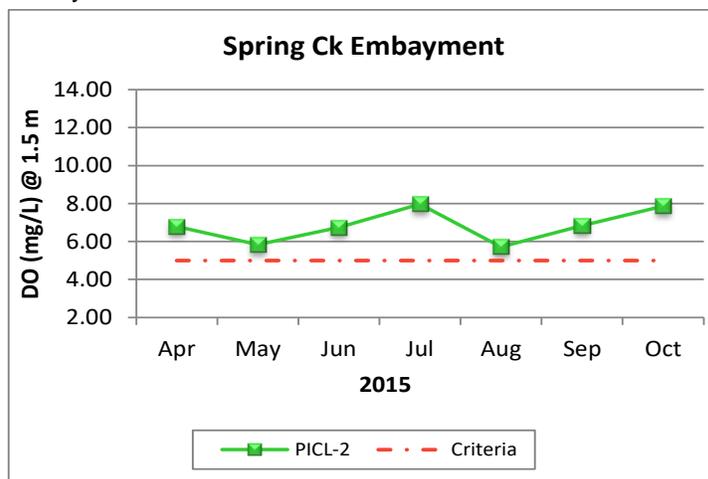


Figure 6. Monthly DO concentrations at 1.5 m (5 ft) for Spring Creek embayment station of Pickwick Reservoir collected April-October 2015. ADEM Water Quality Criteria pertaining to reservoir waters require a DO concentration of 5.0 mg/L at this depth.

## REFERENCES

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